PATENT COOPERATION TREATY

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PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing *(day/month/year)*	24 August 2004 (24.08.2004)
Applicant's or agent's file reference: PCT 320	FOR FURTHER ACTION: See paragraph 2 below
International application No.: PCT/KR 2004/000483	International filing date *(day/month/year)*: 8 March 2004 (08.03.2004)
	Priority Date *(day/month/year)*: 28 March 2003 (28.03.2003)
International Patent Classification (IPC) or both national classification and IPC: C11C 3/10, 3/04; C07C 67/02	
Applicant: KOREA INSTITUTE OF ENERGY RESEARCH	

1. This opinion contains indications relating to the following items:

- [x] Cont. No. I — Basis of the opinion
- [ ] Cont. No. II — Priority
- [ ] Cont. No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Cont. No. IV — Lack of unity of invention
- [x] Cont. No. V. — Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- [ ] Cont. No. VI — Certain documents cited
- [ ] Cont. No. VII — Certain defects in the international application
- [ ] Cont. No. VIII — Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/KR 2004/000483

Continuation No. I

Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of

a translation from the original language into the following language: English, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

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Continuation No. V

Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims ----	YES
	Claims **1-21**	NO
Inventive step (IS)	Claims ----	YES
	Claims **1-21**	NO
Industrial applicability (IA)	Claims **1-21**	YES
	Claims ----	NO

2. Citations and explanations:

AT 406 870 B discloses production of fatty acid alkyl esters useful as a diesel fuel substitute by transesterification of triglycerides with an alcohol in presence of basic catalyst(s) comprising:

(1) the mixture of triglyceride, alcohol and catalyst is converted to form a crude ester phase and a glycerine phase;
(2) the phases are separated;
(3) the crude ester phase is divided into two parts, (A) and (B);
(4) part (A) is purified to give pure fatty acid alkyl ester;
(5) part (B) is mixed with more triglyceride, alcohol and catalyst and converted into two parts (A) and (B); and
(6) steps (2)-(5) repeated.

WRITTEN OPINION OF THE
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International application No.
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WO1995/002661 A2 relates to a method for the preparation of fatty acid alkyl esters comprising transesterification, in particular catalytic transesterification, of triglycerides, wherein from a reaction mixture, in which the transesterification is carried out, an ester phase and a glycerol phase containing fatty acids, fatty acid salts or other fatty acid compounds, are formed, which are separated from each other, characterized in that the fatty acids, the fatty acid salts or other fatty acid compounds are separated from the glycerol phase, esterified with an alcohol selected from the group consisting of methanol, ethanol, propanol, i-propanol, butanol, sec.-butanol, pentanol, hexanol, heptanol and octanol and recycled to a different reaction mixture, in which a further transesterification is carried out.

WO 1993/009212 A1 describes a process for preparing fatty acid esters and mixtures of fatty acid esters of short-chain monohydric alcohols including from 1 to 5 carbon atoms or short-chain diols having from 2 to 5 carbon atoms, which are monoalkylated by alkyl radicals having from 1 to 3 carbon atoms, by trans-esterification of fatty acid glycerides with the alcohols or monoalkylated diols in the presence of a basic catalyst, in a plurality of steps comprising: carrying out a trans-esterification in the presence of from 0.5% to 5.0% of a basic catalyst, based on the amount of fatty acid glyceride, and in the presence of a short-chain alcohol or monoalkylated diol in an excess over a stoichiometric quantity of from 10% to 200% per mol of glycerine-bound fatty acid; and obtaining a relatively lighter fatty acid ester phase and a relatively heavier glycerine phase by settling and separating;
subjecting the relatively higher fatty acid ester phase obtained in step a) to transesterification in the presence of a basic catalyst and a short-chain alcohol or a monoalkylated diol; c) adding at least one-tenth of the relatively heavier glycerine phase obtained in step a), while stirring; and obtaining a fatty acid ester phase and a heavy glycerine phase by settling and separating; d) removing excess short-chain alcohol or monoalkylated diol from the fatty acid ester phase obtained in step c, subsequently stirring in acid and, after a completed phase separation, removing the fatty acid ester phase.

AT 386 222 B discloses a method and apparatus for the continuous production of fatty acid alkyl esters used for fuel comprising transesterification from vegetable and animal oils or fats with a lower alcohols using basic catalyst.

GB 612 667 A relates to a method of alcoholysis of low grade fatty stocks containing at least 5.0% by weight of free fatty acids which comprises reacting the said stocks with a stoichiometric excess of a lower alcohol under acidic conditions in the presence of an acid alcoholysis catalyst to reduce the free fatty acid content of said stocks below 3% by weight, continuing the alcoholysis reaction under alkaline conditions in the presence of an alkaline alcoholysis catalyst, stratifying the reaction mixture and separating a layer containing crude lower alkyl ester components, and distilling the crude lower alkyl esters.

US 5 116 546 A discloses a process for producing fatty-acid lower-alkyl mono-esters comprising a first esterification-step (1) wherein one or more fatty-acid glycerolesters and a monohydric lower-alkylalcohol are reacted in the presence of an alcoholysis catalyst to produce a mixture comprising fatty-acid lower-alkyl mono-esters, fatty-acid glycerolesters and glycerol, a separation step (2) wherein said mixture produced in step (1) is separated into a glycerol-rich fraction (a) and a fraction (b) rich in fatty-acid lower-alkyl mono-ester, and a recovery step (4) wherein said fatty-acid lower-alkyl mono-esters are recovered from said fraction (b), the improvement comprising a second esterification step (3) in which before said recovery step (4) substantially all glycerol and fatty-acid glycerolesters of said fraction (b) are esterified to the corresponding fatty-acid glycerol tri-esters.

EP 0 523 767 A2 is pointed to a process for the production of methyl or ethyl esters from fatty acids and glycerine by transesterification of oils or greases comprising at least two reaction steps, each reaction step having a mixing reactor and a separator for the separation of a light, ester-rich phase and a heavy, glycerine-rich phase. The oil or the fat, the alcohol and the catalyst are added
to the mixing reactor in the first reaction step and these substances are intensively mixed. The alcohol and the catalyst as well as the light, ester-rich phase obtained in the preceding reaction step are added for intensive mixing to the mixing reactor in the second and each further reaction step. A heavy phase is separated in the separator in the second to last reaction step and at least partly fed back to the mixing reactor in the first reaction step. Methyl esters of fatty acids or ethyl esters of fatty acids are obtained from the light, ester-rich phase separated in the last reaction step by at least one further separation treatment. The process is preferably carried out using two reaction steps.

EP 0 535 290 A1 discloses a process and apparatus for continuous production of fatty acid esters comprising from vegetable and animal oils or fats comprising transesterification with monohydric lower alcohols using metal alcoholates as transesterification catalyst, a mixture of alkali metal oxides and/or alkaline earth metal oxides and alkali metal alcoholates and/or alkaline earth metal alcoholates is employed as transesterification catalyst.

AT 394 374 B teaches a method for the production of fatty acid alkyl esters comprising transesterification from vegetable and animal oils or fats with a lower alcohols using basic catalyst.

EP 0562 504 A2 relates to production of lower alkyl esters of higher fatty acids from an oil phase and lower alcohols by catalytic transesterification at reaction temperatures of up to 100 DEG C. in the presence of an alkaline catalyst comprising introducing a mixture of oil phase, alcohol and catalyst at reaction temperature into the top of a first reactor column, at a rate of flow which is lower than the sinking rate of the glycerine separated from the reaction mixture, the reaction mixture is passed into a second reactor for further transesterification, the thus obtained reaction mixture is further freed of glycerine in an initial separating stage by means of a short-term washing,
the reaction mixture is passed into a third reactor with addition of further alcohol and catalyst, and at a rate of flow conforming to the first stage of the process, the reaction mixture is further transesterified, reaction product is freed of the remaining methanol, glycerine, soaps formed and catalyst in a second separating stage, under addition of an aqueous extraction buffer solution, and
the reaction mixture is freed of lower alcohols by stripping, washed with suitable extraction and washing solutions and dried.

EP 127 104 A1 discloses production of fatty acid esters of short-chain, aliphatic alcohols by the catalytic transesterification of natural fats and/or oils containing free fatty acids (oil phase) with the corresponding monoalcohols, the oil phase is subjected to preliminary esterification with the monoalcohols in the presence of acidic esterification catalysts at temperatures no higher than 120 DEG C. and under pressures no higher than 5 bars and in the presence of a liquid entraining agent substantially immiscible with the oil phase, after which the reaction product is separated into an entraining agent phase containing the acidic catalyst and water

of reaction and the treated oil phase, the oil phase is then subjected to transesterification while the acidic catalyst-containing entraining agent phase is returned, after at least partial drying, to the preliminary esterification stage. By this process, fats and/or oils with acid numbers of up to 60 can be processed in the preliminary esterification stage to give an oil phase having a low acid number

Above documents cited in the search report prepared by the Austrian Patent Office represent the prior art coming closest to the subject matter of the present application. Therein, all the features
of the subject matters of present application have already been described.

The cited documents anticipate the subject matters of the present application.
Therefore the subject matters of the present application cannot be regarded as novel.
The subject matters of the present application are obvious and do not involve an inventive step.

Industrial applicability is given.